

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: S1022/8724
Serial No.: Unassigned
Filed: Herewith
For: A SYSTEM FOR THE AUTOMATIC ANALYSIS OF IMAGES, SUCH AS
DNA MICROARRAY IMAGES

Examiner: Unassigned
Art Unit: Unassigned

Box Patent Application
Commissioner for Patents
Washington, D.C. 20231

AMENDMENT

Sir/Madam:

Prior to examination please amendment the above-identified application as follows:

IN THE SPECIFICATION

On page 17, after line 18, please add the following paragraphs.

--Having thus described at least one illustrative embodiment of the invention, various alterations, modifications, and improvements will readily occur to those skilled in the art. Such alterations, modifications, and improvements are intended to be part of this disclosure, and are intended to be within the spirit and the scope of the present invention. Accordingly, the foregoing description is by way of example only and is not intended to be limiting. The present invention is limited only as defined in the following claims and the equivalents thereto.

What is claimed is:--

IN THE ABSTRACT

Please amend the abstract as follows.

Applicant presents the abstract as amended below and encloses a separate sheet indicating the amendments to the abstract with bracketing and underlining.

IN THE CLAIMS

Please amend the claims as follows.

Applicant presents the claims as amended below and encloses a separate sheet indicating the amendments to the claims with bracketing and underlining.

1. (Amended) System for the automatic analysis of images, such as images of DNA microarrays after hybridisation, said images comprising a matrix of points or spots, the system being adapted to be associated with a sensor for acquiring said images and comprising a circuit for processing the signals corresponding to said images generated by said sensor, wherein said processing circuit is configured according to a cellular neural network (CNN) architecture for the parallel analogue processing of said image signals.

2. (Amended) System according to claim 1, wherein said sensor is configured to acquire, as said images, fluorescence images from DNA microarrays.

3. (Amended) System according to claim 1, wherein said cellular neural network architecture comprises matrix of cells locally interconnected by means of synaptic connections, said matrix presenting a spatial distribution which is essentially correlated to the matrix form of said images.

4. (Amended) System according to claim 1, wherein said sensor is a matrix optical sensor.

5. (Amended) System according to claim 1, wherein said sensor is a colour optical sensor.

6. (Amended) System according to claim 1, [characterised in that] wherein said sensor is an optical sensor which is selectively sensitive to distinct chromatic components of said images.

7. (Amended) System according to claim 6, wherein said processing circuit is configured to process signals corresponding only to some of said distinct chromatic components of said images.

8. (Amended) System according to claim 7, wherein said processing circuit [(20)] is configured to process signals associated only to distinct chromatic components of said images (I) with the exclusion of the blue chromatic component.

9. (Amended) System according to claim 1, wherein said processing circuit is configured for processing the signals corresponding to said distinct chromatic components of said images in parallel.

10. (Amended) System according to claim 1, wherein said sensor and said processing circuit are integrated in a single chip.

11. (Amended) System according to claim 1, wherein said sensor and/or said processing circuit implement VLSI CMOS technologies.

12. (Amended) System according to claim 1, wherein said processing circuit is configured to perform on said signals corresponding to said images at least one of the operations selected from the group consisting of:

- background clearing of said images,
- grid analysis of said images,
- elimination of smaller irregular spots,
- elimination of the larger spots,
- intensity analysis, and
- threshold definition.

13. (Amended) System according to claim 1, wherein said processing circuit is configured to combine the processing results obtained in relation to distinct chromatic components of said images.

14. (Amended) System according to claim 13, wherein said combination operation is a logic product (AND – 40).

15. (Amended) System according to claim 1, wherein said processing circuit comprises:

at least one analogue memory for storing signals corresponding to said images and a control logic for running real time processing sequences of said images.

16. (Amended) System according to claim 15, wherein said images and the intermediate processing stages are stored by at least one analogue memory.

17. (Amended) System according to claim 15, wherein said processing circuit comprises means for storing the configuration parameters of said cellular neural network.

18. (Amended) System according to claim 17, wherein said configuration parameters are stored in digital form and said processing circuit comprises a digital/analogue converter to convert said parameters to analogue form in order to be input to said cellular neural network.

19. (Amended) System according to claim 1, wherein said processing circuit processes said signals corresponding to said images by applying sets of parameters (templates) of the cellular neural network.

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Respectfully submitted,

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AMENDED CLAIMS SHOWING THE AMENDMENTS

1. (Amended) System for the automatic analysis of images [(I)], such as images of DNA microarrays after hybridisation, said images [(I)] comprising a matrix of points or spots, the system being adapted to be associated with a sensor [(10)] for acquiring said images [(I)] and comprising a circuit [(20)] for processing the signals corresponding to said images [(I)] generated by said sensor [(10)], [characterised in that] wherein said processing circuit [(20)] is configured according to a cellular neural network (CNN) architecture for the parallel analogue processing of said image signals.

2. (Amended) System according to claim 1, [characterised in that] wherein said sensor [(10)] is configured to acquire, as said images [(I)], fluorescence images from DNA microarrays.

3. (Amended) System according to [any of claims 1 or 2] claim 1, [characterised in that] wherein said cellular neural network architecture comprises matrix of cells [(100)] locally interconnected by means of synaptic connections, said matrix presenting a spatial distribution which is essentially correlated to the matrix form of said images [(I)].

4. (Amended) System according to claim 1, [characterised in that] wherein said sensor [(10)] is a matrix optical sensor.

5. (Amended) System according to [any of claims 1 or 4] claim 1, [characterised in that] wherein said sensor [(10)] is a colour optical sensor.

6. (Amended) System according to [any of claims 1, 4 or 5] claim 1, [characterised in that] wherein said sensor [(10)] is an optical sensor which is selectively sensitive to distinct chromatic components [(R, G, B)] of said images [(I)].

7. (Amended) System according to claim 6, [characterised in that] wherein said processing circuit [(20)] is configured to process signals corresponding only to some [(R, G)] of said distinct chromatic components [(R, G, B)] of said images [(I)].

8. (Amended) System according to claim 7, [characterised in that] wherein said processing circuit [(20)] is configured to process signals associated only to distinct chromatic components [(R, G)] of said images [(I)] with the exclusion of the blue chromatic component [(B)].

9. (Amended) System according to [any of claims 6 to 8] claim 1, [characterised in that] wherein said processing circuit [(20)] is configured for processing the signals corresponding to said distinct chromatic components [(R, G)] of said images [(I)] in parallel.

10. (Amended) System according to [any of the preceding claims] claim 1, [characterised in that] wherein said sensor [(10)] and said processing circuit [(20)] are integrated in a single chip.

11. (Amended) System according to [any of claims 1 or 10] claim 1, [characterised in that] wherein said sensor [(10)] and/or said processing circuit [(20)] implement VLSI CMOS technologies.

12. (Amended) System according to [any of the preceding claims] claim 1, [characterised in that] wherein said processing circuit [(20)] is configured to perform on said signals corresponding to said images [(I)] at least one of the operations selected from the group consisting of:

- [-] background clearing [(201, 301)] of said images [(I)],
- [-] grid analysis [(202, 302)] of said images [(I)],
- [-] elimination of smaller irregular spots [(203, 303)],
- [-] elimination of the larger spots [(204, 304)],
- [-] intensity analysis [(205, 305)]₂ and

[-] threshold definition [(206, 306)].

13. (Amended) System according to [any of claims 6 to 9] claim 1, [characterised in that] wherein said processing circuit [(20)] is configured to combine the processing results [(591, 592)] obtained in relation to distinct chromatic components [(R, G)] of said images.

14. (Amended) System according to claim 13, [characterised in that] wherein said combination operation is a logic product (AND – 40).

15. (Amended) System according to [any of the preceding claims] claim 1, [characterised in that] wherein said processing circuit [(20)] comprises:

[-] at least one analogue memory [(11)] for storing signals corresponding to said images [(I)] and

[-] a control logic [(13)] for running real time processing sequences of said images.

16. (Amended) System according to claim 15, [characterised in that] wherein said images and the intermediate processing stages are stored by at least one analogue memory [(11)].

17. (Amended) System according to [any of claims 15 or 16] claim 15, [characterised in that] wherein said processing circuit [(20)] comprises means [(15)] for storing the configuration parameters of said cellular neural network.

18. (Amended) System according to claim 17, [characterised in that] wherein said configuration parameters are stored in digital form and said processing circuit [(20)] comprises a digital/analogue converter [(14)] to convert said parameters to analogue form in order to be input to said cellular neural network.

19. (Amended) System according to [any of the preceding claims] claim 1, [characterised in that] wherein said processing circuit[.] [(20)] processes said signals

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corresponding to said images [(I)] by applying sets of parameters (templates) of the cellular neural network.

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AMENDED ABSTRACT SHOWING THE AMENDMENTS

The system can be used for the automatic analysis of images [(I)], [comprising] including a matrix of spots, such as images of DNA microarrays after hybridisation. The system can be associated - and preferably integrated in a single monolithic component implementing VLSI CMOS technology – to a sensor [(10)] for acquiring [said] the images [(I)]. The system [comprises] includes a circuit [(20)] for processing the signals corresponding to the images [(I)], configured according to a cellular neural network (CNN) architecture for the parallel analogue processing of signals.

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